MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY FINAL EXAMINATION

TRIMESTER 1, 2016/2017

HBC1011 – BIOCHEMISTRY I

21st OCTOBER 2016
3:00-5:00 PM
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This paper consists of **7** pages (including the front page) with **2** Parts (**A** and **B**).
2. **Part A** consists of **15** Multiple Choice Questions (MCQ). All questions carry equal marks (1 mark per question). Answer **ALL QUESTIONS** in the **OMR** provided on page **4** of this paper.
3. **Part B** consists of **6** Short Answer Type questions. All questions carry equal marks (10 marks per question). Answer **ALL QUESTIONS.** Print your answers **clearly** and **neatly** in the Answer Booklet provided.

PART A: MULTIPLE CHOICE QUESTIONS (MCQ)
Answer ALL questions [15 marks]

1. Select the components and bonding present in RNA.
   A. Nitrogen bases; deoxyribose; phosphodiester bonds.
   B. Nitrogen bases; ribose; phosphodiester bonds.
   C. Nitrogen bases; deoxyribose; *N*-glycosidic bonds.
   D. Nitrogen bases; ribose; amide bonds.

2. Southern blotting is a method used to locate a sequence of:
   A. RNA
   B. DNA
   C. protein
   D. lipid

3. All of below show the examples of active transport, **EXCEPT**:
   A. ATP binding cassette (ABC) transporter
   B. Symporter
   C. Na^+-K^+ ATPase
   D. K^+ channel

4. Which of the two amino acids promote the formation of α helices in a protein?
   A. Valine and isoleucine
   B. Alanine and glutamate
   C. Glycine and asparagine
   D. Leucine and proline

5. Which one of the following statements about protein structure is **TRUE**?
   A. Proteins consisting of one polypeptide can have quaternary structure.
   B. The formation of a disulfide bond in a protein requires that the two participating cysteine residues be adjacent to each other in the primary sequence of the protein.
   C. The stability of quaternary structure in proteins is mainly a result of covalent bonds among the subunits.
   D. The information required for the correct folding of a protein is contained in the specific sequence of amino acids along the polypeptide chain.

6. Which one of the following statements about fluid mosaic model of membranes is **TRUE**?
   A. All membrane proteins are bound to the interior of the membrane.
   B. Both proteins and lipids undergo transverse (flip-flop) diffusion from the inside to the outside of the membrane.
   C. Some proteins and lipids undergo lateral diffusion along the inner or outer surface of the membrane.
   D. The term mosaic refers to the arrangement of the lipids alone.

Continued...

7. Which one of the following statements about vitamin and coenzyme is **FALSE**?
   A. Cytochromes are hemeproteins containing heme groups and are primarily responsible for the generation of ATP via electron transport.
   B. Ubiquinone is a component of the electron transport chain and participates in aerobic cellular respiration, generating energy in the form of ATP.
   C. Biotin is also known as vitamin I or coenzyme B, is a water- soluble B-vitamin.
   D. Tetrahydrofolate is a folic acid derivative.

8. Types of noncovalent bonds or interactions include all of the following **EXCEPT**:
   A. Hydrophobic interactions
   B. Hydrophilic interactions
   C. Ionic bonds
   D. van der Waals force

9. Which chemical can be used to cleave disulfide bonds?
   A. β-mercaptoethanol
   B. EDTA
   C. DNase
   D. Sulfur dioxide

10. The matching pairs below are correct for enzymes, **EXCEPT**:
   A. Proteolytic enzyme - Functions like a cofactor
   B. Holoenzyme – Enzyme that has the required cofactor bound to it
   C. Apoenzyme – Enzyme that does not have the required cofactor bound to it
   D. Allosteric enzyme – Enzymes that do not obey Michaelis-Menten kinetics

11. A major change occurring in the evolution of eukaryotes from prokaryotes was the development of _____.
   A. DNA
   B. plasma membranes
   C. ribosomes
   D. the nucleus

12. Which of the following does not influence enzyme activity?
   A. pH
   B. Temperature
   C. Product degradation
   D. Effectors

13. What is the analytical technique used in protein analysis to measure the mass-to-charge ratio of ions?
   A. Mass spectrophotometry
   B. X-ray crystallography
   C. Nuclear Magnetic Resonance Spectroscopy
   D. Electrophoresis

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14. Which one of the following statements about carbohydrates is **FALSE**?
    A. Reducing monosaccharide includes glucose, glyceraldehyde, galactose, maltose and fructose.
    B. Two joined monosaccharides are a disaccharide.
    C. The examples of non-reducing disaccharides are sucrose and trehalose.
    D. Amylose is a highly branched polymer of glucose found in animals.

15. Which of the following statement about the study of homology is **FALSE**?
    A. Two molecules are said to be homologous if they have derived from a common ancestor.
    B. Protein sequences are better conserved evolutionarily than nucleotide sequences, thus protein sequence comparison produces more reliable and accurate results.
    C. Homologous sequences are orthologous if they are inferred to be descended from the same ancestral sequence separated by a speciation event.
    D. Homologs present in one species and have very similar or identical functions.

MULTIPLE CHOICE QUESTION ANSWER SHEET

TABLE NO: STUDENT ID:

SUBJECT: SUBJECT CODE:

1. (A)(B)(C)(D)	2. (A)(B)(C)(D)	3. (A)(B)(C)(D)	4. (A)(B)(C)(D)
5. (A)(B)(C)(D)	6. (A)(B)(C)(D)	7. (A)(B)(C)(D)	8. (A)(B)(C)(D)
9. (A)(B)(C)(D)	10. (A)(B)(C)(D)	11. (A)(B)(C)(D)	12. (A)(B)(C)(D)
13. (A)(B)(C)(D)	14. (A)(B)(C)(D)	15. (A)(B)(C)(D)	16. (A)(B)(C)(D)

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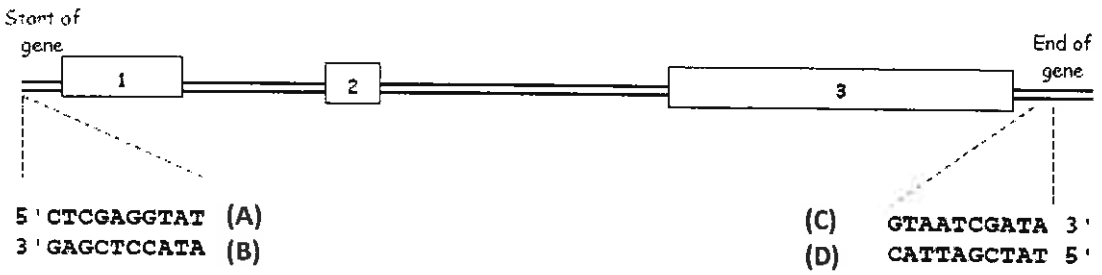
PART B: SHORT ANSWER TYPE (SAT) QUESTIONS

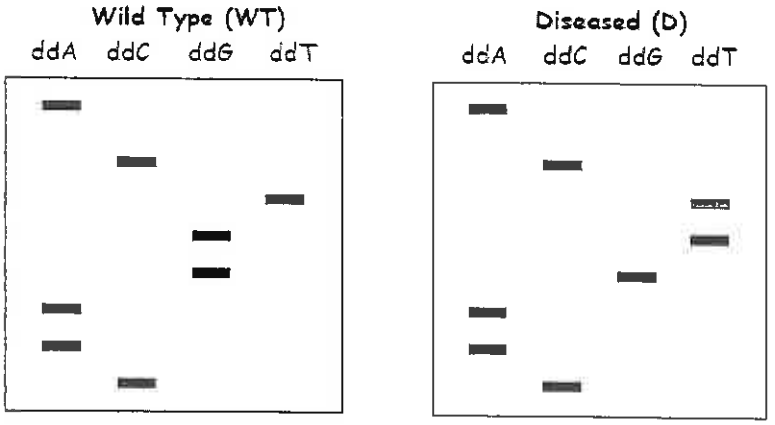
Answer ALL questions [60 marks]

Question 1



A. It is believed that a disruption in a gene, *sokS*, may contribute to an interesting disease phenotype in cardinals. You wish to PCR amplify and sequence *sokS* from both wild type and diseased cardinals. The *sokS* gene is shown above. Exons are represented by numbered boxes and the terminal sequences are depicted in **bold**.For PCR amplification, the primers should be identical to which of the sequences (A, B, C and D) in the diagram? [2 marks]

B. Dideoxy sequencing method was used to sequence the PCR products. The following pattern in the sequencing gel representing the sequence spanning the end of the first intron and the beginning of exon 2. Write the sequences corresponding to wild type and diseased with the 5' and 3' ends.



[2 marks]

C. Name two methods used for the study of gene expression. [2 marks]

D. What is a sequence alignment? [2 marks]

E. Why does DNA with a high A-T content have a lower melting temperature, T_m than DNA with a high G-C content? [2 marks]

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Question 2

A. Suggest a reason why animals that live in cold climates tend to have higher proportions of polyunsaturated fatty acid residues in their lipids than do animals that live in warm climates. [2 marks]

B. Suggest a reason why inorganic ions, such as K^+, Na^+, Ca^{2+} and Mg^{2+}, do not cross biological membrane by simple diffusion. [2 marks]

C. What are the two main features of ion channel? [2 marks]

D. What is the energetic driving force for the formation of phospholipid bilayers? [2 marks]

E. What are the four common features of biological membranes? [2 marks]

Question 3

A. Why are all monosaccharides and disaccharides soluble in water? [2 marks]

B. What is the difference between leptins and glycoproteins? [2 marks]

C. Why is it more difficult to determine the structure of the oligosaccharides, when compared to amino acid sequences? [2 marks]

D. What is the structural feature common to ATP, FAD, NAD^+, and CoA? [1 mark]

E. Why is it possible to argue that vitamin D is not a vitamin? [1 mark]

F. Draw the basic chemical formula of glucose in D- and L-configurations using Fischer projection. [2 marks]

Question 4

A. DNA is more stable to hydrolysis reactions than RNA or protein. Is this consistent with the role of DNA in cells? Explain. [2 marks]

B. Explain the importance of nitrogen to life. [2 marks]

C. Explain the concept of amphipathicity. Give one example of an amphipathic compound. [2 marks]

D. Water has a very small $[H^+]$ (10^{-7}). Adding just a little bit of acid or base can change the pH drastically. How can we minimize pH swing? [2 marks]

E. Hydrogen bonding between water molecules gives water its special properties. What are these 4 special properties? [2 marks]

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Question 5

A. What is a catalyst? List four properties of a catalyst. [5 marks]

B. Define active site of an enzyme. [1 mark]

C. Why is transition state analog a potent inhibitor of an enzyme? [2 marks]

D. How is the enzyme activity regulated? Name two mechanisms. [2 marks]

Question 6

A. How do small and big protein molecules get separated in gel filtration chromatography? [2 marks]

B. Why are side chains important for protein tertiary and quaternary structures? [2 marks]

C. Name two computational methods for protein structure visualization. [2 marks]

D. What is the difference between SDS-PAGE gel electrophoresis and 2D gel electrophoresis? [2 marks]

E. What types of amino residues that would be buried inside a protein structure when the protein is dissolved in lipid? Why? [2 marks]

End of paper